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REC'D PCT/PTO 01 APR 2005  
PCT/G2003/204240

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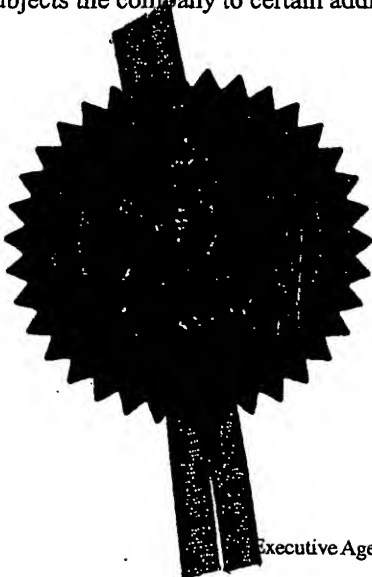
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I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

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Signed

*W. Evans*

Dated 21 October 2003

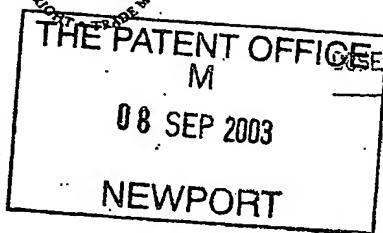
Executive Agency of the Department of Trade and Industry

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# Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)



SEP03 ES35534-1 C81053  
P01/7700 0.00-0320919.4  
The Patent Office

Cardiff Road  
Newport  
South Wales  
NP10 8QQ

1. Your reference

EATAIR3

2. Patent application number

(The Patent Office will fill this part in)

08 SEP 2003

0320919.4

3. Full name, address and postcode of the or of each applicant (underline all surnames)

E. A. TECHNICAL SERVICES LTD

08479081001

Patents ADP number (if you know it)

7-9 RYDAL PLACE

CLITHERDE ROAD

If the applicant is a corporate body, give the country/state of its incorporation

CHATBURN  
LANCASHIRE  
BB74JY

4. Title of the invention

AIR CYCLE HEATING AND COOLING

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Patents ADP number (if you know it)

6. Priority: Complete this section if you are declaring priority from one or more earlier patent applications, filed in the last 12 months.

Country

Priority application number  
(if you know it)

Date of filing  
(day / month / year)

0222770.0

04.10.2002

0310889.1

13.05.2003

7. Divisionals, etc: Complete this section only if this application is a divisional application or resulted from an entitlement dispute (see note f)

Number of earlier UK application

Date of filing

(day / month / year)

8. Is a Patents Form 7/77 (Statement of inventorship and of right to grant of a patent) required in support of this request?

Answer YES if:

- a) any applicant named in part 3 is not an inventor, or
- b) there is an inventor who is not named as an applicant, or
- c) any named applicant is a corporate body.

Otherwise answer NO (See note d)

YES

Patents Form 1/77

Accompanying documents: A patent application must include a description of the invention. Not counting duplicates, please enter the number of pages of each item accompanying this form:

Continuation sheets of this form

Description	1	✓
Claim(s)	0	in
Abstract	0	
Drawing(s)	3	only ✓

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for a preliminary examination and search (Patents Form 9/77)

Request for a substantive examination (Patents Form 10/77)

Any other documents (please specify)

11. We request the grant of a patent on the basis of this application.

Signature(s) *R.D. Driver*

Date 5 SEPTEMBER 2003

12. Name, daytime telephone number and e-mail address, if any, of person to contact in the United Kingdom

RON DRIVER TEL 01200 441492  
rwd@cats.ltd.uk

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

- If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.
- Write your answers in capital letters using black ink or you may type them.
- If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- If you have answered YES in part 8, a Patents Form 7/77 will need to be filed.
- Once you have filled in the form you must remember to sign and date it.
- Part 7 should only be completed when a divisional application is being made under section 15(4), or when an application is being made under section 8(3), 12(6) or 37(4) following an entitlement dispute. By completing part 7 you are requesting that this application takes the same filing date as an earlier UK application. If you want the new application to have the same priority date(s) as the earlier UK application, you should also complete part 6 with the priority details.

Aug 03

Patents Form 1/77

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## AIR CYCLE HEATING AND COOLING

In the present invention it is proposed to use a rolling piston compressor and expander of the type described in PCT/GB01/03089 and PCT/GB 03/00194 and GB2364552 and GB0222770.0 and 0310889.1, and use air or other fluid as the working fluid as described in application.

One machine can act as a compressor while the other can act simultaneously as a turbine providing the expansion, or both can act simultaneously as compressors or turbines. Two machines can be fitted together by any conventional method, for instance, two machines connected by a pulley and drive belt or end to end as shown in figures 2 and 3. Using a pulley and drive belt will mean two separate units with separate mountings but an ability to completely balance each other. If the machines are fitted end to end and the turbine is designed to balance the out of balance forces of the compressor this will create an out of balance couple. The out of balance couple can be eliminated by a counter balance weight fitted to the other side of the compressor. Where the compressor is used in a heat pump to compress a refrigerant in a heating or cooling cycle a substantial amount of useful energy is lost as the refrigerant expands between the condenser and evaporator. When machines described above are used, a combination of turbine and compressor fitted together provide a very efficient machine. There are however millions of refrigerant compressors already in production and supplied throughout the world whose energy consumption could be reduced by attaching a turbine of the type described above in a manner described below.

A refrigerant compressor as described above but without rotating side discs, or refrigerant compressors known in the art, can have a turbine as described above attached to them. The drive between and to the turbine and compressor can be through either the compressor or turbine.

The refrigerant can enter the turbine in the manner described above. As the refrigerant enters the turbine and fills the compartment there will be some refrigerant pressure loss as the refrigerant passes through the rotating side disc and in filling the compartment. If the axial width of the turbine rolling piston is relatively small in relation to the filled compartment volume the refrigerant pressure loss will be relatively small. Under these circumstances one of the turbine rotating side discs can be eliminated.

Figure 1 shows a typical rolling piston compressor.

Figure 2 shows both an expansion turbine and counter balance attached to the compressor

Figure 3 shows a turbine attached to a compressor with the outer casings removed. The compressor has no rotating side discs and can be hinged as described above or one known in the art. The turbine has one rotating side disc but this can be one on each side of the rolling piston.

# Rolling Piston Compressor, Attached Expansion Turbine and Counter Balance with Outer Casings Removed

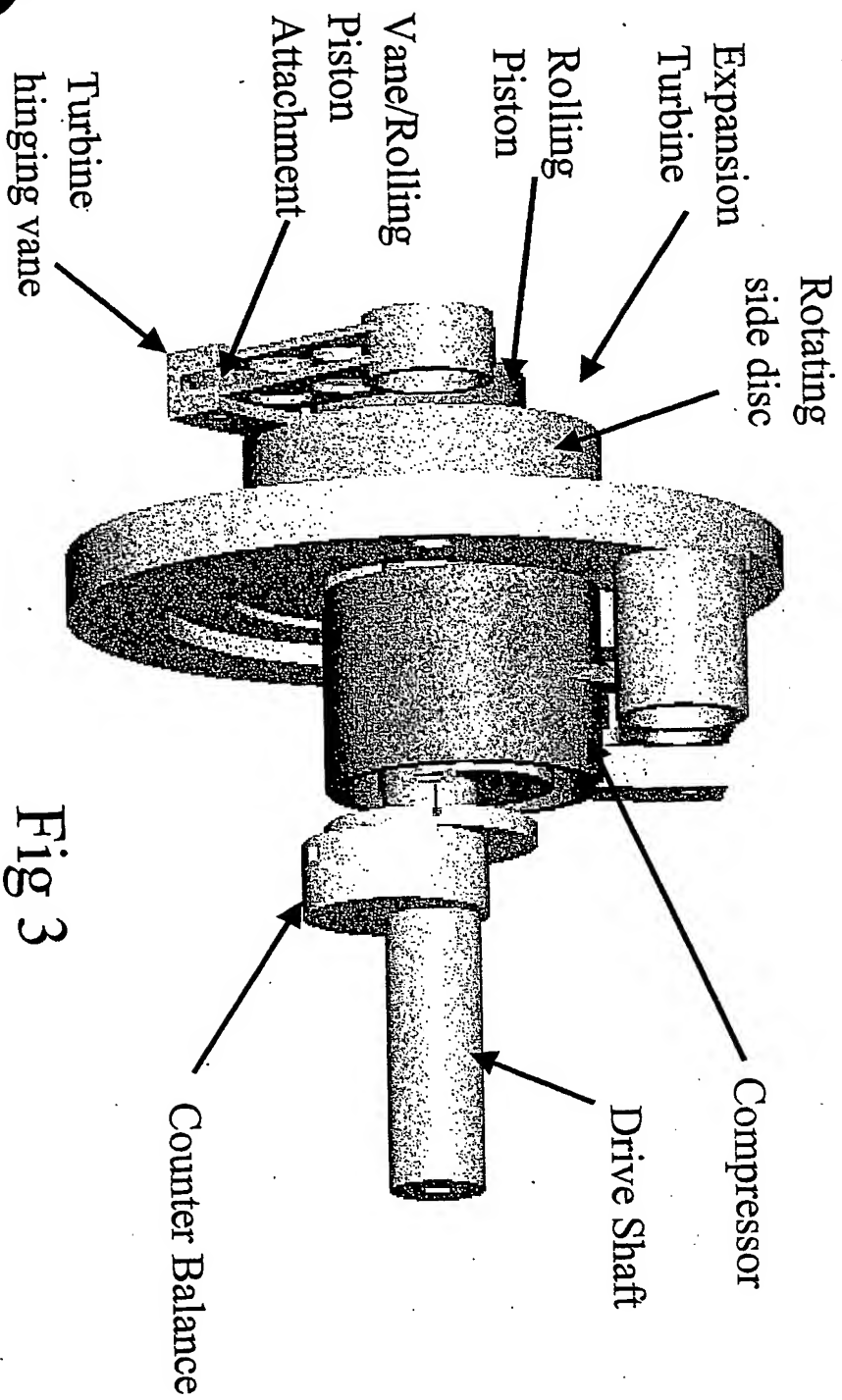


Fig 3

# Rolling Piston Compressor with Attached Expansion Turbine and Counter Balance

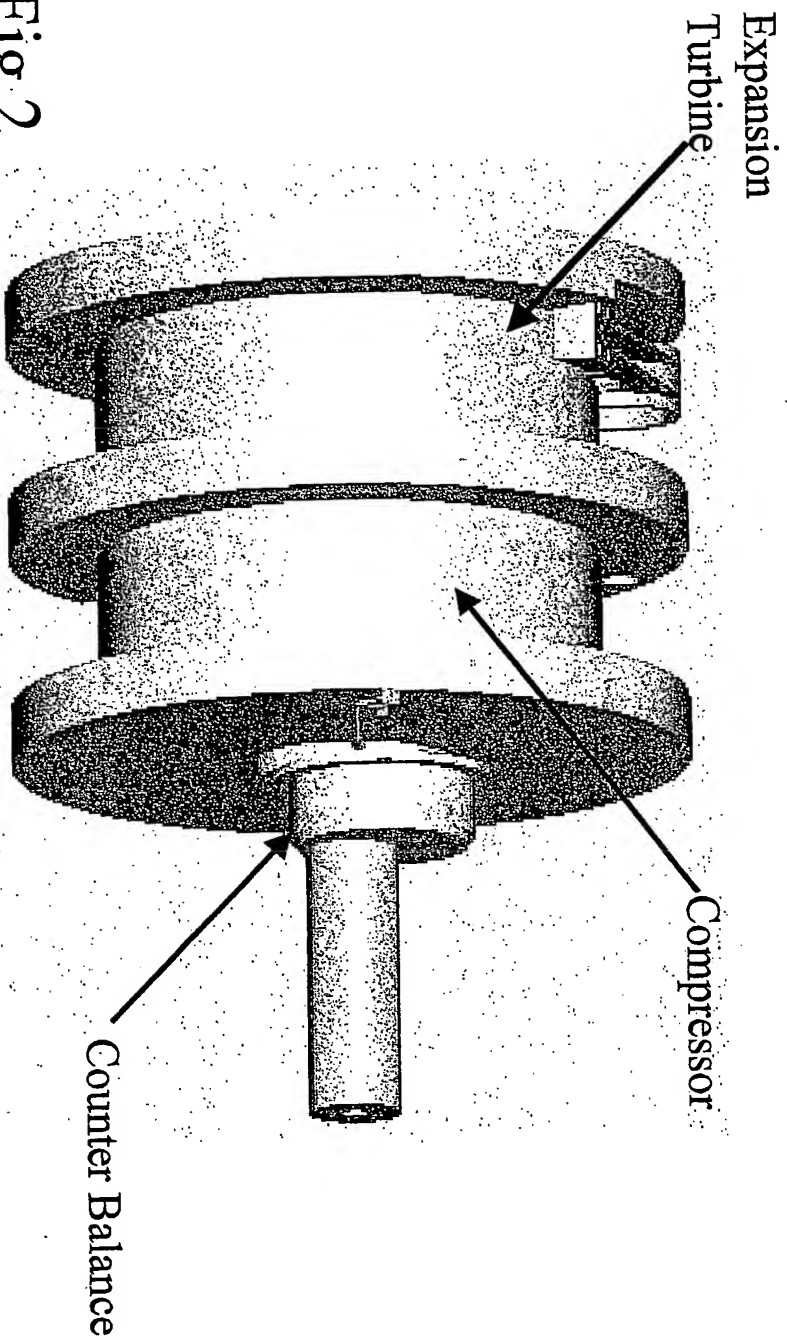


Fig 2

Rolling Piston Compressor

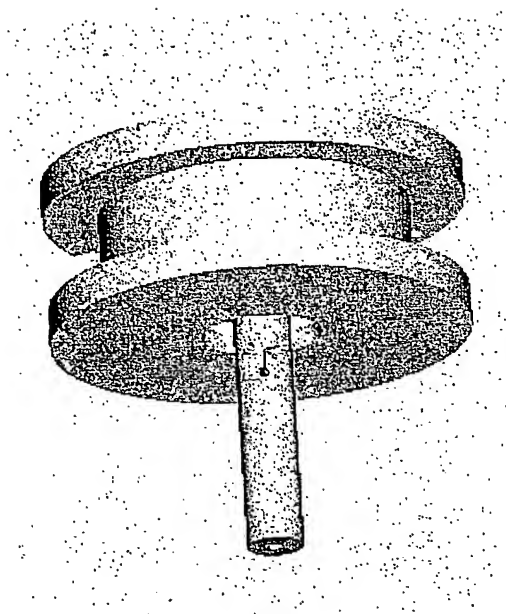


Fig 1